

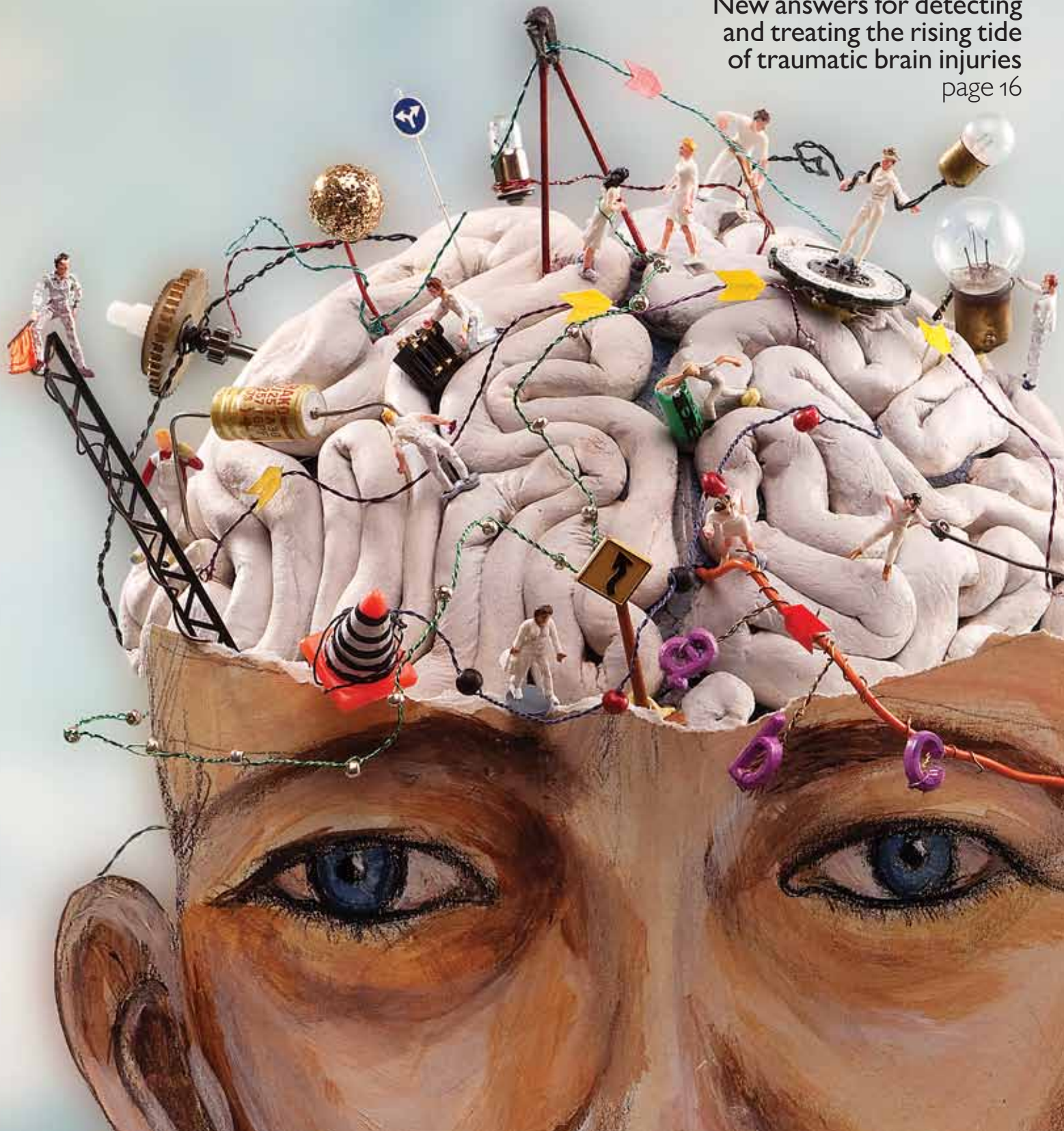
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# HOPKINS

## medicine

### AFTER IMPACT

New answers for detecting  
and treating the rising tide  
of traumatic brain injuries  
page 16





The fog has lifted: Seven years after a brain-injuring car crash, Rick Griffin has returned to giving talks about the Civil War.


A photograph of a stone wall with a window and flags. The wall is made of reddish-brown stones. A white window frame is visible in the upper center. To the left, there are two flags on wooden poles: a red flag and a black flag with a white triangle. The foreground shows a wooden stump and some green foliage.

# after

Some brain injuries go unrecognized. Others get the wrong treatment. Now, Hopkins specialists are developing new ways to find—and fix—the disconnects that keep people sidelined.

# the big bang

by Ramsey Flynn  
photos by Keith Weller



**When Rick Griffin was abruptly slammed back into his headrest** on that crisp October morning in 2003, it took a few moments to figure out what happened. As his vision cleared, he could see the grille of a car wedged into the back of his own.

Next, of course, would come the talking part.

As Griffin attempted to exchange the usual information with the driver who hit him, he found the words slow to form in his mind. They seemed to catch in his mouth as he tried to speak. His head felt “thick.”

The other driver took the pressure off by speaking first: “Oh, my God,” he said. “I wrecked my wife’s car. She’s going to kill me.”

Never mind that the errant driver had also just derailed the life of Griffin, then 60, who had built a successful general contracting business to support his family in suburban Maryland. In this perfectly everyday car crash, Rick Griffin had just joined the ranks of everyday victims of traumatic brain injury (TBI), even if Griffin himself didn’t know it yet.

Like many in those foggy moments that immediately follow such events, Griffin assumed he’d shake it off. He didn’t. It would be three years before he would find his way into a series of new diagnostic protocols advanced at Johns Hopkins—and into new solutions.

**Slowly but surely**, the brain injury field is changing, and the Hopkins brain injury care system that Griffin entered was looking to optimize its own resources. Endowed with an unusual bounty of neurologists, neurosurgeons, brain trauma experts, psychiatrists, psychologists, physiatrists, and its own battalion of brain researchers and therapists, the Hopkins brain injury empire lay scattered across multiple divisions.

Though the group’s skills have kept it atop its specialty’s annual rankings in *U.S. News & World Report* for two decades, leaders here see new pos-

sibilities, and have recently tapped a handful of visionary mid-career specialists to lay the groundwork for a bigger idea.

Their vision is sweeping. “My own dream would be a soup-to-nuts brain injury program,” says one of the main proponents, neuropsychiatrist Vani Rao. “We need a system that covers patients from the onset of their injury to their return to the community. We need to make sure there’s a systematic flow.”

On a national scale, no academic medical institution has made the great leap into forging a one-stop-shopping system for brain injury in all its forms, to include trauma, stroke, Alzheimer’s, and a host of other brain-harming conditions.

Just from national statistics, the idea seems inevitable. Approximately 1 in every 17 Americans suffers some form of brain impairment from all causes. That’s over 16 million people, or the size of the entire population of metropolitan New York City. “The opportunity is just huge,” says rehabilitation neuropsychologist Kate Kortte, another proponent of the new system, who directs Hopkins’ outpatient brain injury rehab program. “It would be great if the whole system could pull together to optimize outcomes for patients without them ever having to leave the Hopkins umbrella.”

Though the decentralized nature of brain injury treatment groups here makes it hard to assemble a Hopkins-wide set of figures, most agree on the scale of the national picture. Apart from causes such as strokes and various other brain pathologies, consider just the basics for trauma cases:

- 5.3 million Americans are currently living with a TBI-related disability.
- 2.5 million will suffer a TBI incident this year.
- 500,000 of those will be hospitalized.
- 50,000 TBI victims will die from the condition.
- 80,000 TBI survivors will develop long-term disabilities, eight times more than the number annually diagnosed with breast cancer.

Add into this group the rising number of combat-blast victims returning from the war zones in Iraq and Afghanistan, and the specialty takes on an entirely new set of treatment issues, especially with the little-known blast wave effects on the human brain. Since the onset of combat operations in 2000, according to the Pentagon’s own count, the number of troops hit with TBI as of May was nearly 179,000.

On the domestic front, the TBI alarm bells also grew louder this spring for the previously underplayed scourge of sports concussions—especially for American football, where young men are trained to lead with their heads. In a national gathering hosted by Hopkins in Washington in June, a series of candid presentations highlighted undercharted TBIs in the NFL and, indeed, at the collegiate level, where Hopkins neuropsychiatrist Kostas Lyketsos cited a University of North Carolina study showing the average college player takes 950 blows to the head in a single season.

At the same gathering, Boston University scientist Ann McKee presented disturbing slides of brain slices gathered from the autopsies of 13 career NFL players. Virtually all of them bore striking evidence of chronic traumatic encephalopathy, with images in which the otherwise healthy normal brain tissue was shrunken and clouded by black patches. Such presentations helped accelerate a bold new awareness campaign: By mid-July, hundreds of concussion warning posters began flooding NFL locker rooms, sponsored by the league's own players' union. Titled "Concussion, A Must Read for NFL Players," the posters urge all participants in the game to "take brain injuries out of play," highlighting long-term consequences like memory loss, personality changes, depression, and early-onset dementia.

Currently, some of Hopkins' most valuable contributions to the field stem from two key areas. First, scientists are developing tools to identify mild forms of TBI in patients where traditional protocols fall short. And Hopkins rehab experts have devised new ways to tap the institution's deep bench of specialists to help get brain-injured patients—including stroke victims and others—back into the game of life.

**In those first months** after his 2003 crash, Rick Griffin was preoccupied with the pains and tingles in his neck, shoulder, right arm, leg, and three fingers. He figured his general sense of disorientation would naturally disappear with time. That notion quickly faded as Griffin prepared to give a public talk that drew on his great passion for key events in the Civil War—especially those that revolved around his Maryland home in Darnestown.

While Griffin was gearing up to discuss a pivotal day in 1861—where the battle between North and South "could have gone either way" in determining the conflict's larger outcome—he suddenly noticed that too many of his most treasured storytelling details were missing. He could no longer recall the troop numbers, their locations and movements amid the complex terrain, or the character traits of the men who led the fighting. Quietly panicked, Griffin canceled all further talks.

During the course of his dozens of sessions with physical therapists, Griffin began to articulate the sort of concern that might not show up on the radar of a health professional oriented toward restoring limb functions: "Something's not right."

By the time Griffin found his way into a Hopkins study in Fall 2006, his prevailing sense of not right had settled like a dark net over much of his life. He felt blue, but couldn't put his finger on why.

When he came into the custody of Hopkins TBI expert Vani Rao, Griffin only suspected his injury might have contributed to his chronically dimmed mood. But Rao's protocols soon brought out a veritable checklist of key indicators of something more.



**Vani Rao's dream: a "soup to nuts" brain injury program at Hopkins "that covers patients from the onset of their injury to their return to the community."**

In the course of interviews with Griffin and his wife—along with other clinical evaluation techniques—key patterns emerged. Post-crash, the patient lacked his former zeal. He suffered extended episodes of listlessness and surprising lapses in memory. His thought processing was slowed. His word-finding skills were off.

In themselves, these bits of data were enough to confirm that Griffin suffered severe depression as a result of TBI.

Because Griffin's brain scans displayed no prominent focal lesions, his symptoms technically qualified his as a mild traumatic brain injury, or MTBI. These are believed to account for about 85 percent of all brain injuries, and are often maddeningly difficult to confirm.

But Hopkins neuroimaging experts have joined other leading groups in looking for new diagnostic techniques that promise to map more MTBI cases. As part of Griffin's participation in the study, Rao's group applied an advanced scanning technique aimed at identifying key neurochemical and serum markers that researchers believe could one day be used as indicators of one of MTBI's most elusive

Rehabilitation neuropsychologist Kate Kortte (far right) pulled together a comprehensive team to treat stroke survivor Matt Lanigan. Therapy such as horseback riding has speeded his recovery.



corollaries, diffuse axonal injury (DAI).

The condition—in which head trauma shears the delicate axons that carry signals from one healthy neuron to the next—is notorious for eluding imaging efforts after a TBI victim's initial injury. That's because the disconnections themselves don't show as neuronal death, which would readily appear as lesions in scans. Insidiously, axonal damage can also unfold slowly over the course of days and weeks.

TBI experts have longed for a reliable way to confirm DAI with a noninvasive procedure, Rao explains.

In Griffin's case, Rao's group applied the technique of magnetic resonance spectroscopy imaging (MRSI). In analyzing the results, Rao's colleagues found areas of abnormal levels of N-acetylaspartate/creatine ratio and reduced choline/creatine ratio. Though researchers believe these markers may

suggest DAI, clinical groups like Rao's do not yet have adequate control baselines to apply the data diagnostically.

Still, Rao was able to tell Griffin that his scan results showed "abnormalities," and that her group's separate clinical findings confirmed he suffered from an MTBI-related case of depression.

This wasn't exactly happy news for Griffin, but at least he now had an answer. The diagnosis not only explained his compromised powers of recall; it also explained the broader pall of declined activity that had settled in as he progressively backed away from so many of the activities that had propelled him out of bed every day.

But there was something else, said Rao: She and her Hopkins colleagues knew ways to retrieve some of the old Rick Griffin.



**At certain stages, and for select patients,** it seems, brain injury rehabilitation at Johns Hopkins can take unexpectedly comic turns. This happens a lot in the office of Kate Kortte, who has developed a special knack for artfully blending the grim realities of brain loss with a thinly repressed instinct for stand-up comedy.

Such moments come fast and thick during her July visit with Matt Lanigan, a 21-year-old part-time data manager for the National Security Agency. In April 2009, Lanigan suffered a case of ulcerative colitis that ultimately threw a clot in his brain. It caused a stroke, choking off much of the nerve center that rules the left side of his body. His left arm and leg became paralyzed. He could barely speak at all.

On this day, with his initial injury more than a year behind him, Lanigan hopes to set a new benchmark by taking on more work hours. As Lanigan enters Kortte's office flanked by both parents, Kortte instantly notes that he is no longer using a cane. His left arm is supported by a structured sling that flattens his fingers onto a splint in a bid to coax them back into higher function.

As he has done for each of their previous meetings, Lanigan has produced his own carefully type-written battle plan for today's session. He hands copies to all parties.

"Ah, yes," teases Kortte as she receives the orders, complete with smartly grouped bullet points. "The agenda, sir! You want to get business done, you must always start with an agenda."

"Let's hit work first," says Lanigan, cutting to the chase. "I would really like to increase to eight hours."

This is familiar territory. Kortte puts the agenda sheet aside and leans toward Lanigan. "So," she begins, in mock-tease mode, "what do you think my concerns are going to be? What am I gonna bring up now?"

Lanigan responds in a sing-song voice: "My little brain?" he says, as his parents and Kortte erupt in laughter.

Recovering, Kortte affirms his response. Over the past months, Lanigan's brain has been steadily re-sorting functions, from the injured tissue to his healthy reserves. Until the brain fully adapts, his daily flow of energy will be highly taxed; fatigue will continue to dog him.

But he's getting there, Lanigan presses. He's no longer whipped at the end of a workday. His supervisors no longer handle him with kid gloves. "I got discharged from speech therapy," he says, describing one recent test in which the therapist "tried pretty hard" to rattle him with a series of timed rapid-fire questions. His walking pace has hit 2.6 miles per hour on the treadmill. His horseback-riding therapy has progressed to a trot, increasingly engaging both arms.

"Pretty cocky," smiles Kortte, sensing her patient's rising confidence as he progresses through the full court press of modern therapies.

And there's more, Lanigan says. At work, he has harnessed a cluster of Microsoft programs to design and run three data tracking and dissemination schemes, complete with an Outlook calendar system with associated spread sheets for triggering due dates and reminder schedules. "I live and die by this spreadsheet and the Outlook calendar," he says. "I came up with this all on my own. I designed it and I use it."

Lanigan is no longer whipped at the end of a workday. "I got discharged from speech therapy," he says. And his walking pace has hit 2.6 miles per hour on the treadmill.

When Kortte opens the floor to parental observations, Lanigan's mom, Renee, cites her son's recent displays of impatience as a good thing. It was one of Matt's signature pre-stroke traits, she says. "It's like he's getting his personality back."

Kortte agrees, then turns to her patient. "Things are just clicking much better for you," she says. "You're doing more natural shifting, organizing yourself, getting this task done, that task done, taking a phone call. You're juggling."

With the sense that Lanigan's progress has hit a new high, Kortte thinks there's some value in pausing to look at how far he's come. She's been the ringleader of an individually tailored, comprehensive dose of Hop-

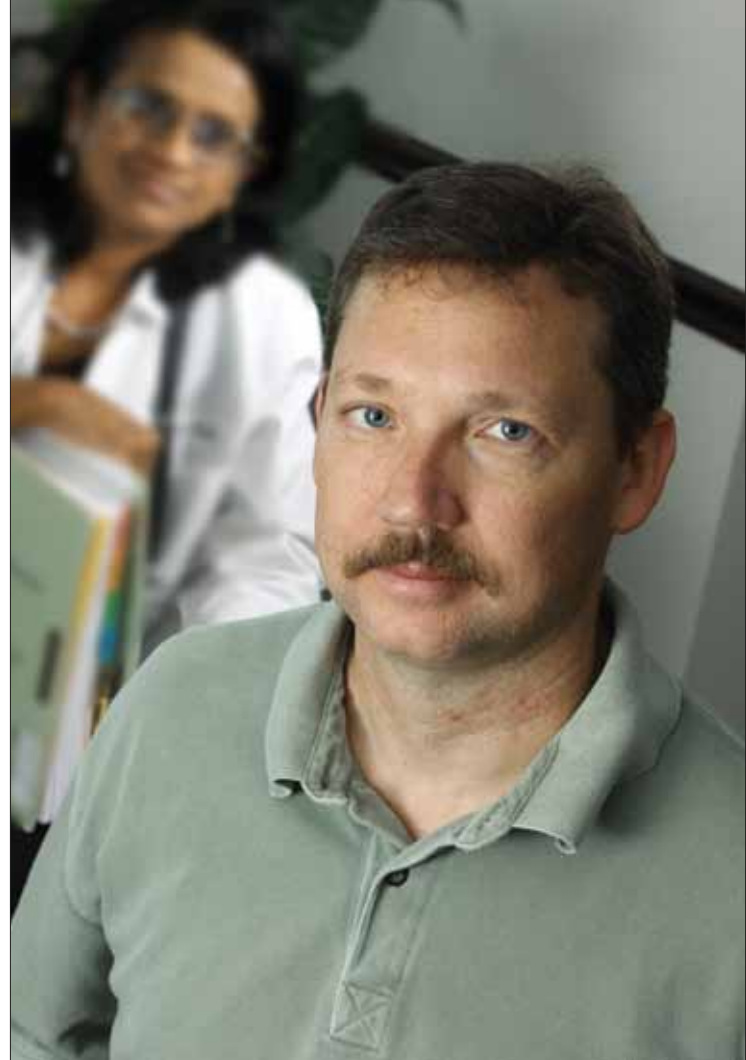
kins-directed rehab: occupational therapy, physical therapy, speech therapy, cognitive rehabilitation, social therapies, and horseback riding. All are headed up by specialists in an interdisciplinary approach aimed at stimulating the injured brain, "to get it to say, 'Hey, I need you,'" says Kortte, "so recruit, upgrade, get that communication between neurons going."

It's working for Lanigan, she says. "Now you're like snap! snap! snap!," she says. "Really, you're *on!*"

In a separate interview, Kortte describes how Lanigan is one of her favorite examples of what can happen when a brain rehab patient's care is orchestrated in a comprehensive fashion. When he first arrived at Hopkins more than a year ago, she explains, he got a full team evaluation. They devised plans to improve his gait, his mobility, his balance issues, his speech-language issues, and ways to address basic life skills like how to dress and bathe with compromised limb function.

The team meets every Tuesday, says Kortte, drilling down into the details for up to six of their 85 ongoing active patient cases. "What we do is scientifically based," she says. "All of our techniques are validated in the literature."

Kortte is also among the voices calling for a blending of the brain-injured patient population



across all causes, including the full spectrum of trauma causes and those stemming from epilepsy, multiple sclerosis, and stroke. "When you talk about getting back into life," she says, "there is no difference."

**Among Hopkins' brain injury cases,** Vani Rao likes to describe a group she believes represents an especially critical challenge for patients, families, neuropsychiatrists, and for society at large. What happens when a patient's injury knocks out too much of their brain's frontal lobes—areas that govern traits like judgment, insight, executive functions, and even morality—the area Rao likes to call "the CEO of the brain"?

**When brain injured patients lose too much of their frontal lobes, they're inclined to become impulsive and disinhibited. They "lose their filters," says Rao. "There are no gates there."**

**After a construction accident, Terry Conner lost all inhibition, which eventually turned into a criminal issue. "I had never been in trouble before," he says. "I was a straight arrow kind of guy."**

Such patients, Rao says, are inclined to become impulsive and disinhibited, prone to behaviors they would have easily rejected prior to their injuries. These people “lose their filters,” she says. “There are no brakes. There are no gates there.”

She describes the case of Terry Conner, a former homebuilder whose life had been high-functioning until the day he fell off a scaffold in a construction accident in Fall 1997, hitting his head on asphalt and slipping into a coma for nearly a month. When he regained consciousness just before winter, Conner, then 34, had no recall of courting and marrying his wife of six months.

“I was a basket case,” says Conner, now 48. “I was literally a basket case.” Just regaining his physical capacities was a major project, says Conner, whose loss of a major portion of his brain’s fronto-temporal lobe made both walking and talking difficult. “I couldn’t look up without losing my balance,” he says.

He also lost his balance in the larger sense, verbally expressing whatever thoughts popped into his mind, and touching whatever looked appealing to him. “My inhibition was zero,” he says, “so I offended everybody.”

Conner’s inability to keep his hands to himself turned into a criminal issue. He began impulsively touching females, without any special regard for their consent—or for their age. Then an incident unfolded in a North Carolina Walmart, where a security officer observed Conner sexually touching an unwitting young cashier. Conner was arrested, jailed, and put into “solo lock-down” for several months. Conner’s defense attorney entered a guilty plea, explaining to a judge that Conner had no history of such behaviors prior to his brain injury. The judge sentenced Conner to time served.

Conner’s father, who once worked for Hopkins Medicine and remembered its skills with handling sexual disorders, drove his son to Baltimore. Conner was now a convicted sex offender, soon facing divorce proceedings from an estranged wife who succeeded at barring him from unsupervised visits with their two young children.

As his treatment began, Conner tried to reckon with a rising tide of emotional rejections from most friends and family. “It’s a very lonely life,” he says from his small apartment in downtown Baltimore.

Once entered into the Hopkins brain injury rehab system, Conner got the full work-up. Rao arranged for him to participate in a series of both group and individual talk therapy sessions, all aimed at “interrupting his behavior and re-scripting his life.”

Hopkins sexual disorders expert Fred Berlin also administers a twice-monthly injection to knock out Conner’s libido, which mutes a broad range of his previously uncontrolled impulses.

In his 30 years in the field, says Berlin, he’s had about a dozen cases like Conner’s, and he believes

many more are out there. They pose a growing issue in nursing homes, says Berlin, and other similarly disinhibited TBI patients are simply relegated to prison instead of treatment. Berlin says the cases pose one of society’s ultimate dilemmas: The patients themselves have been seriously injured through no fault of their own, he says, and yet the community has a rightful obligation to protect other innocent citizens. Even the most thoughtful courts don’t know what to do. “It’s clearly quite a burden,” says Berlin, “and perhaps it’s time we talked about it.”

“Terry’s getting well-integrated,” says Shari Keach, a Hopkins clinical therapist who has met weekly with Conner for over five years. “He’s very different now. Terry is not a dangerous guy. He still has worth.”

Though Conner says he still finds it difficult to compare his post-injury self to the man he used to be, he knows the basics. “I was always an easy, friendly person,” he says. “I had never been in trouble before. I was a straight-arrow kind of guy. I’m trying to live a normal life now, but brain damage is getting in the way of everything.”

Rao is hopeful for Conner’s fruitful return to society, calling him a “poster case” for what brain injury rehab can do. Berlin was one of Conner’s first Hopkins doctors, explains Rao, but the complexities of his case soon drew on the skills of others in an otherwise scattered brain injury system, including pharmacologists, psychologists, psychiatrists, and social workers. “In the end,” says Rao, “we were able to formulate his problem, in a very full-perspective way. That’s very Hopkins.”

Rao traces the roots of such comprehensive case work to Hopkins predecessors like Paul McHugh and Philip Slavney, who conceptualized the approach in their seminal 1998 book, *Four Perspectives of Psychiatry*. Rao says the duo’s work provided clinicians with structured tools to separate a patient’s psychiatric disorders into manageable parts.

**With a separate set of struggles now largely past him,** former general contractor Rick Griffin is also finding his way back into the game.

In Fall 2008, two years after his Hopkins treatment commenced, Griffin felt summoned back to the podium by the tug of his own family connections to the Civil War. The occasion was a visit to the unmarked Georgia gravesite of Griffin’s great-great-grandfather, who’d been a twice-wounded private for the South. Against the backdrop of war re-enactors flanked by cannons, Griffin stood up, took a deep breath—and confidently recited the tale, with barely a glance to his written notes.

Now 67, Griffin says his mental agility is still not what it was. Yet, he says, “I have regained a degree of competency that I thought I’d lost.” \*